**In the Claims:**

1. - 66. (cancelled)

67. (currently amended) A material discrimination system including a high energy X-ray source a ~~in which the~~ first detector component in the form of [[is]] a thin scintillation crystal ~~which is required to register~~ for registering an amount of energy deposited by an X-ray that is essentially independent of the X-ray ~~MeV~~ energy, ~~wherein a low Z~~ a low-Z converter [[is]] located after this crystal to stop electrons produced by X-ray interactions downstream of the thin crystal from being significantly back scattered into the ~~front~~ thin crystal and prevent electrons leaving the ~~front~~ thin crystal from returning and depositing more energy in the ~~front~~ thin crystal, and a thicker downstream scintillation crystal, wherein the low-Z converter is situated between the thin ~~front scintillation~~ crystal and [[a]] the thicker ~~downstream scintillation~~ crystal~~, and is adapted to reduce the back scatter of electrons into the front crystal and to prevent electrons which have left the front crystal from returning thereto~~.

68. (currently amended) A material discrimination system as claimed in claim 67, wherein the low Z converter is formed of aluminum.

69 - 72. (cancelled)

73. (currently amended) A material discrimination system as claimed in claim [[71]] 67, wherein behind the low-Z converter is located a high-Z, high density converter ~~convertor, whose main purpose is to ensure that even the higher MeV energy components of an X-ray beam lose energy at the maximum rate so that the electro-magnetic cascade reaches equilibrium, to ensure that the maximum amount of energy per X-ray is deposited in the following crystal, so that it will respond preferentially to higher energy X-rays~~.

74. (cancelled)

75. (cancelled)

76. (currently amended) A material discrimination system as claimed in claim 73, where the high-Z ~~material is~~ converter is formed of tungsten.

77. (currently amended) A material discrimination system as claimed in claim 73, wherein electrons travelling backwards out of the ~~said~~ thicker downstream crystal as a result of multiple Coulomb scatter[[,]] are absorbed in both the low and high-Z converters so that they are unable to reach the thin front crystal.

78. (currently amended) A material discrimination system as claimed in claim 77, wherein high-Z, high density converters[[,]] are interleaved with scintillating crystals.

79. (previously presented) A material discrimination system as claimed in claim 78, wherein each crystal is read out by a pair of photodiodes or pair of fibres.

80. (previously presented) A material discrimination system as claimed in claim 79, wherein signals from all such pairs of read out devices are added which increases the effective energy of the high energy X-ray component that is registered, and hence the magnitude of the material discrimination effect.

81. (currently amended) A material discrimination system as claimed in claim 78, wherein an absorber is located at the rear of ~~the~~ a detector assembly, to stop electrons produced by X-rays

which carry on downstream and scatter in any structure to the rear of the apparatus[[,]] from reaching the rear crystal of the detector array.

82. (currently amended) A material discrimination system as claimed in claim 81, wherein the absorber is formed of aluminum.

83. (currently amended) A material discrimination detector for ~~x-ray~~ X-ray inspection using high_energy X-rays in which ~~the~~ a thin front crystal is read out from each side [[as]] by a photodiode, or optical fibre, and the ~~outputs~~ output signal from the two opposite sides of the crystal are added, so as to prevent any left/right asymmetry in an output signal ~~which can result from reading out at one end only, with respect to direction of motion of the object under investigation relative to the detector~~.

84. (cancelled)

85. (cancelled)

86. (currently amended) An X-ray inspection/material discrimination system detector comprising a front thin crystal and a rear thick crystal, wherein the latter is read out by a plurality of ~~photodiodes or fibres or other~~ read out devices which sample at different depths in the beam direction, and the signals from the different sampling devices are added to represent ~~the~~ a high energy X-ray component.

87. (currently amended) A detector as claimed in claim 86, wherein outputs from ~~the two~~ opposite sides of the rear crystal are combined to prevent left/right asymmetry.

88. (cancelled)

89. (cancelled)

90. (cancelled)

91. (cancelled)

92. (currently amended) A detector as claimed in claim [[91]] 87, wherein the crystals are read out by optical fibres ~~leading to CCD cameras~~ or photodiodes ~~and all of the read-outs are combined to produce a signal corresponding to the high energy X-ray component~~.

93. (currently amended) A material discrimination detector for use in an X-ray discrimination system for ~~x-ray~~ X-ray inspection using high energy X-rays ~~wherein the~~ including separate front and rear scintillation crystals which are cut from the same ingot of material in order to provide matched performance.

94. (cancelled)

95. (cancelled)

96. (currently amended) A detector as claimed in claim 93, wherein the crystal material is CsI ~~and the choice of material is such as to minimise persistence of the signal due to low phosphorescence decay~~.

97. (currently amended) A material discrimination system for ~~x-ray~~ X-ray inspection using high energy X-rays which includes a Linac for generating high energy X-rays, a detector, and ~~wherein the~~ a detector read-out system ~~is synchronised to the~~ ,means for synchronising the read-out system with each Linac pulse, with one read-out cycle for each pulse, ~~and in which~~ wherein the read-out system also samples the output from crystals of the detector between each Linac pulse, so as to provide signals indicative of noise and crystal persistence.

98. (currently amended) A system as claimed in claim 97 including means for selectively triggering the Linac on a Linac pulse, wherein the Linac is triggered on each alternate pulse only, and during non-beam read-outs, signals corresponding to background, noise and crystal persistence, are subtracted.

99. (cancelled)

100. (cancelled)

101. (cancelled)

102. (currently amended) A material discrimination system for ~~x-ray~~ X-ray inspection using high energy X-rays ~~which incorporates~~ including a Linac in which the channels are normalised

so as to overcome non-linear effects due to saturation, and calibration is performed by increasing the X-ray beam flux by known increments.

103. (currently amended) A system as claimed in claim 102, wherein calibration is performed using a step wedge of absorbing material with increments of thickness chosen to yield fixed decrements of transmission between 90% and 10% ~~when used with a particular Linac~~.

104. (cancelled)

105. (cancelled)

106. (previously presented) A system as claimed in claim 103, wherein the step wedge is formed from PTFE.

107. (previously presented) A method of calibrating a system as claimed in claim 103, involving moving the step wedge across the X-ray beam and determining the average signal value vs. step thickness, for use as a base level for channel to channel normalisation.

108. (previously presented) A method of calibrating a system as claimed in claim 107, wherein the step wedge is formed from PTFE.

109. (currently amended) A method of material discrimination using X-rays which is performed by generating calibration curves of material discrimination effect (MD) ~~verses~~ versus transmission T, where T is 1 for zero ~~absorbtion~~ absorption and 0 for completely absorbing

objects, and the MD effect is derived from the lower and high energy signals, and calibration is performed using step wedges of suitable absorbing material.

110. (currently amended) A method of claim 109, wherein a range of curves for calibration is produced using different materials ~~such as PTFE, aluminium, and iron,~~ whereby the effective Z of an unknown material can then found by comparing its MD effect and T value with the corresponding values of known materials, and then interpolating.

111. (currently amended) A method of testing for the presence of a material whose effective Z is different depending on whether high or low energy X-rays are employed, comprising the steps of inspecting an object under test using high energy X-rays and noting the effective Z of the constituents of the object, inspecting it using low energy ~~Z-rays~~ X-rays and noting the effective Z of its constituents, ~~and~~ comparing the values of Z obtained from the two tests for the each identified constituent in the object, and using a look-up table of Z ratios for the two X-ray energies[[,]] to assist in determining the identity of each constituent.